

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on November 29, 2011 has been entered.

Status of the Claims

2. By amendment filed November 29, 2011 claims 30, 31, 33-35, 40-44, 46 and 48 have been amended and claims 39 and 45 have been cancelled. Claims 30-38, 40-44, 46-48 are currently pending. Claim 37 has been given the wrong status identifier of "Previously Presented" but is being treated as amended.

Response to Arguments

3. Applicant's arguments, filed November 29, 2011, with respect to the rejection(s) of the claim(s) by Uemura in view of Okudaira have been fully considered and are persuasive as neither references teaches having used C2F6 plasma to etch/roughen the sublayer surface. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of new prior art necessitated by the amendment to the claims as the use of a plasma comprised of C2F6 combined with oxygen was known in the art for etching silicon dioxide surfaces.

4. Applicant's arguments of unexpected results from the use of plasma comprised of C2F6/O2 are not persuasive because the evidence presented within the specification is not commensurate with the scope of the claims. The evidence presented in Table 2 Page 12 of the specification of the present application only shows that etching of silicon dioxide achieved a RMS roughness of approximately 6 nm while the claims require a RMS roughness in the range from 2.116 to 30 nm. Furthermore, the claims required up to 50% by volume of oxygen within the plasma and it is not clear from the information provided on Page 12 Table 2 what amount of oxygen was present within the plasma to obtain the presented results. The evidence presented on Page 18 Table 6 are not persuasive because these results were only obtained from plasmas comprised of either 20% oxygen or 50% oxygen whereas the claims require a range of up to 50% oxygen. Furthermore, no RMS roughness values are presented with the results shown within Page 18 Table 6. Likewise the information presented in Page 21 Table 9 is not persuasive because no RMS roughness values are presented for the given results.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

7. Claims 30-32, 34-37, 42-44 and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al (European Patent Publication No. 0476510A1) in view of Namose (U.S. Patent # 5,173,151) and Murphy et al (U.S. Patent Publication No. 2002/0064663).

Uemura teaches a process for providing water repellency to a glass plate. The glass plate had deposited onto its surface a transparent metal oxide film layer which was further treated to provide fine unevenness to the metal oxide film layer surface. The water repellency was provided by applying a water repellent to the uneven metal oxide film layer surface which caused the water repellent/hydrophobic agent to graft/bond onto the metal oxide film layer surface.

(Abstract, Page 2 Lines 20-23 and Page 2 Line 56 through Page 3 Line 2)

Uemura further teaches that the metal oxide film layer/sublayer formed was comprised of Silicon dioxide (Page 2 Lines 45-49 and Page 3 Lines 21-28).

The specification of the present application discloses that the term “activated” means that a surface has undergone a treatment which has modified its electrostatic state and/or its chemical state (creation or destruction of chemical functional groups), in order to increase the reactivity of said surface, which treatment may go as far as tearing the material of the surface, thus creating irregularities (Page 3 Lines 17-24 of the specification of the present application).

As was discussed previously, Uemura had the sublayer surface roughened prior to application of the water repellent material and further teaches that this was accomplished by plasma etching (Page 3 Lines 48-54). Thus Uemura teaches having activated the sublayer surface by plasma etching followed by applying the hydrophobic agent while the surface was in an activated/roughened state.

Though Uemura teaches that the silicon dioxide sublayer was etched to activate the sublayer it does not teach that the gas used was in the form of plasma comprised of hexafluoroethane (C₂F₆) combined with oxygen in an amount up to 50% by volume of the etching plasma.

Namose teaches a method for plasma etching a silicon dioxide layer wherein plasma comprised of hexafluoroethane was used (Abstract). Furthermore, Namose teaches that it was known in the art to have combined the fluorine plasma with oxygen in order to enhance the effectiveness of the plasma by inhibiting the recombination between fluoride radicals formed in the plasma (Column 2 Lines 9-20).

Based on the teachings of Namose, at the time the present invention was made it would have been obvious to one having ordinary skill in the art to have used a C₂F₆ plasma combined with oxygen as the plasma etchant gas in the plasma etching step of Uemura since this type of plasma treatment was a known and effective plasma treatment in the art for etching silicon dioxide films.

As for the limitation that the oxygen was present in an amount up to 50% by volume of the etching plasma neither Uemura nor Namose specifically teach this but as was discussed

previously the oxygen was combined with the plasma to inhibit the recombination of fluoride radicals.

At the time the present invention was made it would have been obvious to one having ordinary skill in the art to have determined optimum values for cause effective variable such as the oxygen concentration in the hexafluoroethane plasma of Uemura in view of Namose through routine experimentation in order to prevent the recombination of fluoride radicals. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990)

Though Uemura in view of Namose teach having activated the sublayer by etching/roughening prior to application of the hydrophobic agent, neither Uemura nor Namose specifically teach that the surface of the sublayer was roughened to an RMS roughness of 2.116 to 30 nm.

Murphy teaches a method for the formation of a hydrophobic surface coating on a substrate (Abstract) wherein the substrates included glass substrates comprised of a silicon oxide (SiO_x) anchor/sublayer which was formed prior to applying the hydrophobic surface coating (Pages 1-2 Paragraphs 0014-0015). Murphy teaches that the silicon oxide surface was roughened to have a RMS roughness of between 4.0 and 6.0 nm (Page 2 Paragraph 0019), which was within the required range 2.116 to 30 nm.

Based on the teachings of Murphy, it would have been obvious to one having ordinary skill in the art to have roughened/etched the silicon dioxide sublayer of Uemura in view of Namose to a RMS roughness of between 4.0 and 6.0 nm since this range was a known RMS roughness range in the art for providing an effective anchor/sublayer surface for the application of a hydrophobic silane compound.

As for claim 31, Uemura does not specifically teach that the hydrophobic agent was deposited within 1 second to 15 minutes after the surface has been activated.

However, it would have been obvious to one having ordinary skill in the art to have determined the optimum values of the relevant process parameters through routine experimentation in the absence of a showing of criticality. *In re Aller*, USPQ 233 (CCPA 1955)

The time lapse between surface activation and hydrophobic agent deposition was a relevant process parameter because it affected the entire production time to complete the hydrophobic layer formation process. By shortening the time between each processing step and thereby shortening the entire production time overall production would thus have increased. Thus it would have been obvious to one of ordinary skill in the art to have determined the optimal time to wait before applying the hydrophobic agent after activation of the sublayer surface (either by etching or cleaning) through routine experimentation. Furthermore, Uemura provides no teaching or suggestion that there would have been a significant time lag between when the surface of the sublayer was activated and when the hydrophobic agent was applied.

As for claim 32, Uemura teaches an example wherein a coated substrate was plasma etched for 10 minutes (Example 2 Page 3), thus Uemura teaches having monitored the activation by monitoring how long the coated substrate was subjected to plasma.

As for claims 34 and 35, Uemura teaches an example wherein the metal oxide/silicon dioxide sublayer was deposited under vacuum by PECVD (thus low-pressure PECVD) using a SiH₄ precursor and an oxidizer in the form of N₂O followed by plasma etching/activation within the same apparatus (thus in the same chamber or in a separate chamber) (Example 3 Pages 3 and 4).

As for claim 37, Uemura teaches that the water repellent layer was deposited onto the activated surface by flow-coating (Page 3 Lines 32-36) and that typical agents used were fluorosilanes (Page 2 Lines 7-10).

As for claims 42 through 44, Uemura teaches that the thickness of the metal oxide sublayer affected the weather resistance of the of the coated glass substrate (Page 4 Lines 24-26) and that the metal oxide sublayer had a layer thickness of not less than 0.05 microns or 50 nm (Page 4 Lines 37-39). Thus, Uemura teaches a sublayer range which overlapped with the claimed ranges of 20 to 250 nm, 30 to 100 nm and 30 to 75 nm.

Overlapping ranges are *prima facie* evidence of obviousness. It would have been obvious to one having ordinary skill in the art to have selected the portion of Uemura's sublayer thickness range that corresponded to the claimed range. *In re Malagari*, 182 USPQ 549 (CCPA 1974)

As for claim 46, Uemura does not teach that the actual developed area of the sublayer after activation had an area of at least 40% greater than the initial plane area.

Murphy teaches that the increase in surface area due to roughening was a cause effective variable because the increase in surface area increased the amount of hydrophobic silane compound per unit area that could have been deposited onto the substrate and thus improving the durability properties of the resulting coating (Page 2 Paragraph 0018).

Based on the teachings of Murphy, it would have been obvious to one having ordinary skill in the art to have determined the optimum developed/activated area increased over initial plane area of the substrate of Uemura by roughening through routine experimentation because the increased area due to activation/roughening affected how much hydrophobic material per unit

area may have been deposited onto the surface of the substrate. *In re Woodruff*, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990)

8. Claim 33 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al in view of Namose and Murphy et al as applied to claim 30 above, and further in view of Anzaki et al (U.S. Patent # 6,328,857).

The teachings of Uemura in view of Namose and Murphy as they apply to claim 30 have been discussed previously and are incorporated herein. Though Uemura teaches that the metal oxide film/sublayer was deposited by sputtering (Page 2 Lines 53-55), Uemura does not specifically teach that the sputtering deposition method was a vacuum cathode sputtering method.

Anzaki teaches a sputtering method comprised of cathode sputtering within a vacuum environment (Abstract), thus Anzaki teaches a method of vacuum cathode sputtering. The method of Anzaki comprised depositing metal oxide including silicon dioxide materials (Column 5 Lines 58-64 and Column 6 Lines 58-67) onto flat plate like substrates including window glass (Column 2 Lines 5-16 and Column 6 Lines 45-53). Anzaki further teaches that the substrate temperature during sputtering was room temperature (Column 6 Line 41) and thus the material was deposited cold.

Based on the teachings of Anzaki, at the time the present invention was made one of ordinary skill in the art would have had a reasonable expectation of success in having deposited the silicon dioxide sublayer of Uemura cold onto the glass substrate by vacuum cathode

sputtering since vacuum cathode sputtering was a known method in the art for depositing silicon dioxide layers onto glass plate substrates.

9. Claim 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al in view of Namose and Murphy as applied to claim 35 above, and further in view of Komada (U.S. Patent Publication No. 2001/0038894).

The teachings of Uemura in view of Namose and Murphy as they apply to claim 35 have been discussed previously and are incorporated herein. As was discussed previously, though Uemura teaches that the silicon-containing precursor comprised silane (SiH₄) Uemura does not teach that the precursor further contained hexamethyldisiloxane, tetraethoxysilane and tetramethyldisiloxane.

Komada teaches a method for the formation of a silicon oxide film by plasma chemical vapor deposition wherein the film was used as a barrier film (Abstract). Komada teaches that the barrier film was formed by plasma CVD using a raw gas mixture of an oxygen containing gas and a silicon compound gas (Page 8 Paragraphs 0136 and 0138) wherein the silicon compound gases comprised one or more silicon compound gases such as hexamethyldisiloxane (HMDSO), tetramethyldisiloxane (TMDSO) and tetraethoxysilane (TEOS) (Page 8 Paragraphs 0140-0141).

Based on the teachings of Komada, at the time the present invention was made one of ordinary skill in the art would have had a reasonable expectation of success in having further included HMDSO, TMDSO and TEOS in the silane precursor gas of Uemura in view of Namose and Murphy because these were known gases in the art for plasma enhanced chemical vapor deposition of a silicon dioxide barrier film.

10. Claims 38 and 47 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al in view of Namose and Murphy et al as applied to claim 30 above, and further in view of Akamatsu et al (U.S. Patent # 6,017,609).

The teachings of Uemura in view of Namose and Murphy as they apply to claim 30 have been discussed previously and are incorporated herein.

In the case of claim 38, though Uemura teaches that the glass substrate was formed by a plate, and thus would have to have either a plane or curved face, (Page 2 Lines 20-23) Uemura does not specifically teach that the plate was a monolithic or laminated glass, a glass ceramic or that the treated substrate is a hard thermoplastic.

Akamatsu teaches a water-repellent glass plate (Abstract) wherein the glass substrate which formed the water-repellent glass plate was formed of a laminated glass plate (Column 3 Lines 20-33).

Based on the teachings of Akamatsu, at the time the present invention was made it would have been obvious to one having ordinary skill in the art to have used as the glass plate substrate in the method of Uemura a laminated glass plate since these types of glass plates were known in the art for being the base substrate for a water-repellent glass plate.

As for claims 47, though Uemura teaches having used a silane including a polyfluoroalkyl group containing silane as the hydrophobic/surface treating agent (Page 2 Lines 7-10), Uemura does not teach having used any agent that would have fit within the scope of compound C formula (II) of claim 47.

Akamatsu teaches the use of water-repellent/hydrophobic fluorosilanes agents that would have been covered by formula (II) of claim 47 (Column 3 Lines 52-59).

Based on the teachings of Akamatsu, it would have been obvious to one having ordinary skill in the art to have used the fluorosilane water-repellent agents of Akamatsu in the method of Uemura because the fluorosilane agents of Akamatsu were known water-repellent agents in the art for surface treating glass substrates.

11. Claims 40 and 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al in view of Namose and Murphy et al as applied to claim 30 above, and further in view of Chartier et al (U.S. Patent # 5,800,918).

The teachings of Uemura in view of Namose and Murphy as they apply to claim 30 have been discussed previously and are incorporated herein. Though Uemura teaches that the metal oxide layer/sublayer was comprised of metal such as silicon, titanium and aluminum (Page 2 Lines 45-48), Uemura does not specifically teach silicon dioxide layer further comprising aluminum, titanium carbon, zirconium, zinc or sulfur.

Chartier teaches a glass substrate comprised of an essentially mineral sublayer onto which was attached a hydrophobic layer (Abstract). Chartier teaches that the mineral sublayer comprised a mixture of oxides including silicon oxides, zirconium dioxide, aluminum dioxide and titanium dioxide (Column 2 Lines 9-16).

Based on the teaches of Chartier, at the time the present invention was made it would have been obvious to one having ordinary skill in the art to have formed the sublayer of Uemura as a silicon dioxide layer further comprising zirconium dioxide, aluminum dioxide and/or

titanium dioxide since it was known in the art to form a sublayer comprised of a mixture of such metal oxides and thus further including aluminum, titanium and or zirconium in the silicon containing layer.

As for claim 41, as was discussed previously, though it would have been obvious to have included aluminum in the silicon-containing layer of Uemura, neither Uemura nor Chartier teach that the layer comprised up to 8% by weight of aluminum.

However, section 2144.05.II.A of the MPEP states, “Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. “[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation.” *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)”

Thus, at the time the present invention was made it would have been obvious to one having ordinary skill in the art to have determined optimal concentration of aluminum in the sublayer of Uemura in view of Chartier through routine experimentation since the general conditions of the sublayer were taught by the art.

12. Claim 48 rejected under 35 U.S.C. 103(a) as being unpatentable over Uemura et al in view of Namose and Murphy a et al as applied to claim 30 above, and further in view of Nakamura et al (U.S. Patent # 5,413,865).

The teachings of Uemura in view of Namose and Murphy as they apply to claim 30 have been discussed previously and are incorporated herein. As was discussed above, Uemura

teaches having grafted/bonded the hydrophobic agent to the surface of the roughened sublayer and Uemura further teaches that the hydrophobic/surface treating agent was a silane containing fluorine groups (Page 2 Lines 7-10). Uemura however, does not specifically teach that the layer of hydrophobic agent had a weight per unit area of grafted fluorine between 0.1 $\mu\text{g}/\text{cm}^2$ and 3.5 $\mu\text{g}/\text{cm}^2$.

Nakamura teaches a method for the formation of a water-repellant glass substrate comprised of applying a silane coating containing a fluorocarbon to a roughened metal oxide surface of the glass substrate (Column 1 Lines 7-14 and Column 2 Lines 41-52). Nakamura teaches that the amount of fluorocarbon, thus fluorine, applied to the surface was a cause effective variable because the amount applied, thus grafted/bonded to the substrate surface, affected the water repellency properties of the substrate surface (Column 5 Lines 3-6).

Based on the teachings of Nakamura, it would have been obvious to one having ordinary skill in the art to have determined the optimum value of fluorine amount per unit area applied and grafted to the surface of the metal oxide layer of Uemura through routine experimentation since the amount of fluorine affected the water-repellency properties of the substrate surface. *In re Malagari*, 182 USPQ 549 (CCPA 1974)

Conclusion

Claims 30 through 38, 40 through 44 and 46 through 48 have been rejected. No claims have been allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael Wieczorek whose telephone number is (571)270-5341. The examiner can normally be reached on Monday through Friday; 6:00 AM to 3:30 PM (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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